

THE LARVAE AND PUPAE OF THREE PHYCITINE SPECIES
(LEPIDOPTERA: PYRALIDAE) THAT OCCUR IN FLORIDA¹

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Abstract.—The last stage larvae and the pupae of *Hypargyria slossonella* (Hulst), *Davara caricae* (Dyar), and *Sarasota plumigerella* Hulst are described. Larvae of these species were collected from *Hippocratea volubilis* L., *Carica papaya* L. and *Coccoloba uvifera* (L.), respectively. Information on feeding behavior and seasonal occurrence of the 3 species is included.

Heinrich's 1956 revision of the Phycitinae included many species found in tropical America. We provide information on the immature stages of three of these phycitines that occur in the United States in southern Florida. Of these, *Hypargyria slossonella* (Hulst) feeds as a larva on *Hippocratea volubilis* L., and appears to be of no economic importance; however, one of the others, *Davara caricae* (Dyar) is a pest of the fruit of papaya (*Carica papaya* L.) (Bruner et al., 1945), and the third, *Sarasota plumigerella* Hulst, feeds on the leaves, flowers, and seed capsules of sea grape (*Coccoloba uvifera* (L.)), which is sometimes used in ornamental plantings.

MATERIALS AND METHODS

Insects included in this study were all collected as larvae from host plants. Notes were made of feeding damage at the time larvae were collected, and photographs of feeding injury were taken either in the field or upon returning to the laboratory. A small number of the last stage larvae present at the time of collection were killed in hot water, and subsequently fixed and preserved in Kahle's fluid; the remaining larvae were reared to obtain pupae and adults. Pupae were fixed and preserved like the larvae.

Larvae were reared in either Ziplock[®] plastic bags or large plastic refrigerator trays containing part of the host plant and usually a small amount of moist sand. Following adult emergence, genitalia slides were prepared of representative specimens and identifications made following Heinrich (1956).

Information on the color of living larvae is given in parentheses. All other color descriptions are based on preserved larvae and pupae. The setal nomenclature follows Hinton (1946) for larvae, and Neunzig and Merkel (1967) for pupae.

Measurements are for preserved specimens. The widths of the larval head

¹ Paper No. 8700 of the Journal Series of the North Carolina Agricultural Research Service, Raleigh, North Carolina 27650.

capsule, larval body and pupal body were measured at the widest points. Lengths of pupae may be somewhat exaggerated because abdominal segments tend to expand during fixation.

All the material is deposited in the NCSU Insect Collection, Raleigh.

Hypargyria slossonella (Hulst)

Salebria slossonella Hulst, 1900a: 170.

Last stage larva (Figs. 1, 7, 10).—Length 13.2–17.0 mm, avg. 15.5 mm; width 1.9–2.2 mm, avg. 2.1 mm.

Color.—Head pale yellowish-brown with pale brown to brown tonofibrillary platelets (faint green undertones and brown to black platelets in living larva); labrum yellowish-brown; antennae yellowish-brown; mandibles mostly yellowish-brown, reddish-brown distally; spinneret pale brown.

Prothoracic shield pale whitish-yellow to pale yellowish-brown, with some darker markings, to mostly brown (pale brown to mostly black with yellowish-green to lime green undertones posteromesally in living larva); most pigmentation on ventral part of shield represents anterior part of sst and est stripes.

Prespiracular plates pale yellowish-brown with brown platelets and sometimes other maculation (pale brown with green undertones to mostly black in living larva).

Remainder of prothorax mostly yellowish-white (mostly pale yellowish-white to green in living larva); sst and est stripes, when present, dark brown to black (purple to dark brown or black in living larva).

Meso- and metathorax and abdomen mostly yellowish-white, sometimes with faint, fragmented red md and sd stripes (green to reddish-brown md and sd stripes and pale yellow to yellow overlap of segments dorsally in living larva) and dark brown to black sst and est stripes (sst and est stripes dark reddish-brown or purple to black in living larva) (interstitial areas and area ventral to stripes in living larva pale yellow, yellowish-green, or lime green, sometimes mottled with red).

Mesothoracic SD1 pinacula rings dark brown (black in living larva).

Eighth abdominal segment SD1 pinacula rings dark brown (dark brown to black in living larva).

Thoracic legs mostly pale brownish-yellow (brown and pale brown in living larva).

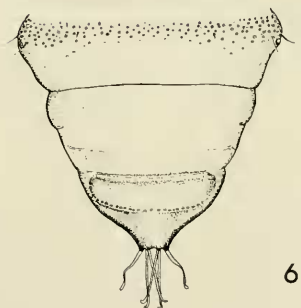
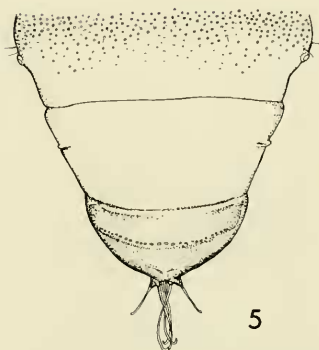
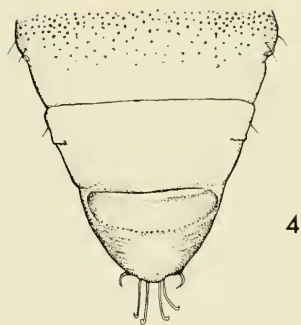
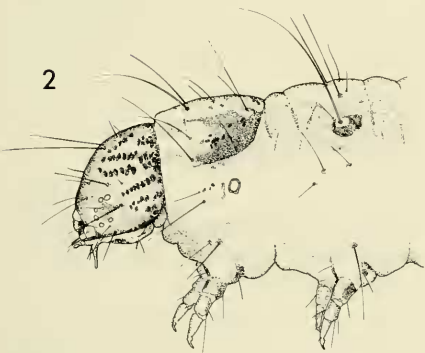
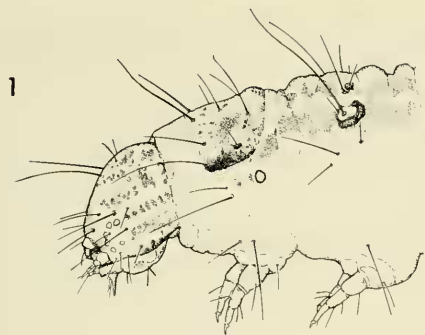
Anal shield whitish-yellow to brownish-yellow with darker platelets and maculation (sometimes with broad black maculation laterally in living larva).

Pinacula pale brown to dark brown (D and SD1 pinacula sometimes dark reddish-brown to black, relatively large and distinct in living larva).

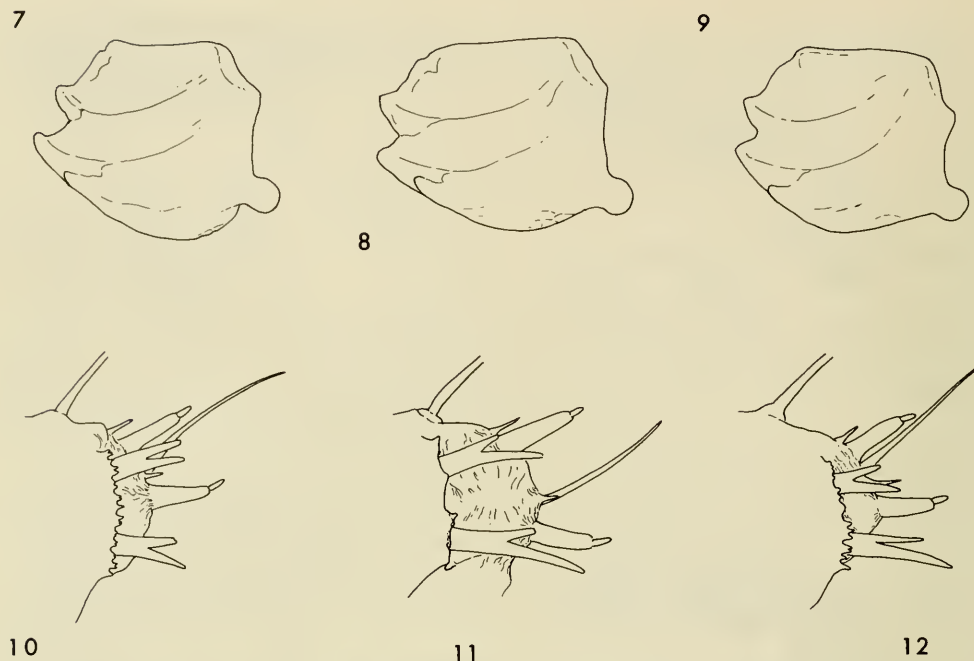
Tonofibrillary platelets on remainder of body indistinct.

Head.—Width 1.25–1.55 mm, avg. 1.47 mm; surface slightly sculptured; adfrontals reach ca. $\frac{2}{3}$ distance to epicranial notch; AF2 setae usually at level of forking of epicranial suture; AF2 setae usually slightly below imaginary line between P1 setae; P1 setae further apart than P2 setae; labrum shallowly emarginate; mandibles simple, distal teeth distinct; mesal sensilla trichodea forked with 2 teeth; spinneret long, ca. $7\times$ as long as medial breadth.

Prothorax.—Shield with distance between D1 setae less than distance between XD1 setae, on each side distance between SD1 and SD2 setae greater than distance



Figs. 1-6. 1-3, Lateral view of head, prothorax, and mesothorax of last stage larvae. 1, *Hypargyria slossonella*. 2, *Davara caricae*. 3, *Sarasota plumigerella*. 4-6, Dorsal view of caudal segments of pupae. 4, *H. slossonella*. 5, *D. caricae*. 6, *S. plumigerella*.



Figs. 7-12. 7-9, Right mandible of last stage larva in mesal view. 7, *Hypargyria slossonella*. 8, *Davara caricae*. 9, *Sarasota plumigerella*. 10-12, Distal part of left maxilla of last stage larva in dorsal view. 10, *Hypargyria slossonella*. 11, *Davara caricae*. 12, *Sarasota plumigerella*.

between SD1 and XD2 setae, distance between D1 and D2 setae greater than distance between D1 and XD1 setae, and XD2, SD1 and SD2 form an acute angle; prothoracic L setae nearly vertical.

Meso- and metathorax.—SD1 pinacula rings of mesothorax well developed; on each side of mesothorax and metathorax D1 and D2 pinacula fused and SD1 and SD2 pinacula usually fused; SD1 setae on mesothorax ca. $2\times$ as long as SD1 setae on metathorax.

Abdomen.—Anterior segments with D2 setae ca. 0.8 mm long, D1 setae ca. $0.5\times$ as long as D2 setae; distance between D1 and D2 setae on each side of segments 3-6 slightly less than distance between D1 and SD1; segments 1-7 lack pinacula rings at base of SD1 setae; crochets in a tri- to biordinal ellipse, number on prolegs of segments 3, 4, 5, 6 and anal segment 66-84, 68-86, 60-84, 70-94, and 56-90, respectively; spiracles of segment 8 with vertical diam. ca. $2\times$ those of segment 7, with horizontal diam. ca. $1.1\times$ distance between L1 and L2 setae; SD1 rings of segment 8 relatively broad and complete; SD1 setae of segment 8 ca. $1.8\times$ as long as SD1 setae of segment 7; 2 SV setae on each side of segments 8 and 9; on each side of segment 9, D1 usually about equidistant from D2 and SD1; all pinacula separate.

Pupa (Fig. 4).—Length 7.3-9.2 mm, avg. 8.3 mm; width 2.2-2.5 mm, avg. 2.4 mm.

Color.—Yellowish-brown to pale reddish-brown; 10th abdominal segment dark reddish-brown; gibba mostly dark reddish-brown.

Head.—Slightly wrinkled; pilifers usually narrowly separated by labial palpi; length of maxillae 4.7–5.4 mm, avg. 5.0 mm; setae minute.

Thorax.—Prothorax slightly wrinkled; spiracles present, mesothorax slightly wrinkled, without punctures; metathorax slightly wrinkled with ca. 45 punctures on each side of meson, extending ca. $\frac{2}{3}$ distance from meson to lateral margin; setae minute.

Abdomen.—Segments 1–4 with proximal $\frac{2}{3}$ densely punctate dorsally; punctures of 4 not reaching spiracles; segments 5–7 with distinct punctures encircling proximal $\frac{1}{2}$ to $\frac{2}{3}$ of segments; spiracles elliptical, slightly raised, length ca. 0.06 mm; segment 4 with D1, SD1 and L2 setae; segments 5–7 with D1, SD1, L2, and SV2 setae; segment 8 with L2 setae; segments 9 and 10 without setae; gibba 3.5–3.7 \times as wide as median length; caudal margin of gibba with small punctures; cremastral “spines” consisting of 2 relatively robust, hooked, mesal “spines,” 2 shorter, slender, simple adjacent “spines,” and 2 lateral, relatively robust, short, simple “spines.”

Material examined.—Florida, Upper Key Largo, 6 larvae, *Hippocratea volubilis*, 21-V-1978, L. R. Grimes; 10 larvae, *H. volubilis*, 20-V-1979, L. R. Grimes, 10 pupae reared from additional larvae, same data.

Distribution.—*H. slossonella* is found in the United States only in southern Florida. It apparently also occurs in Mexico in the state of Oaxaca (Heinrich, 1956).

Biology.—Like most tropical insects, *H. slossonella* has several generations each year. Heinrich (1956) listed February, March, and April as months in which adults were collected in southern Florida. During the present study, early to half-grown larvae were collected in late May, and these became adults in June and July. Probably additional generations are produced in late summer and fall.

Small larvae consume the upper or lower epidermis and mesophyll of leaves of the liana *Hippocratia volubilis* L. As the larvae develop they form small, loose protective structures on the host plant from silk, frass, and surrounding leaves. The initial external evidence of larval feeding consists of pale areas on the outer surface of the leaves (Figs. 13, 14). Late stage larvae silk together larger clusters of whole, partially eaten, and dead leaves. Several larvae frequently inhabit each enclosure. Larger, somewhat more tightly constructed, frass and silk tubes are made by each larva (Fig. 15), and entire parts of leaves are consumed, particularly the leaf margins (Fig. 15). Pupation occurs primarily in the soil.

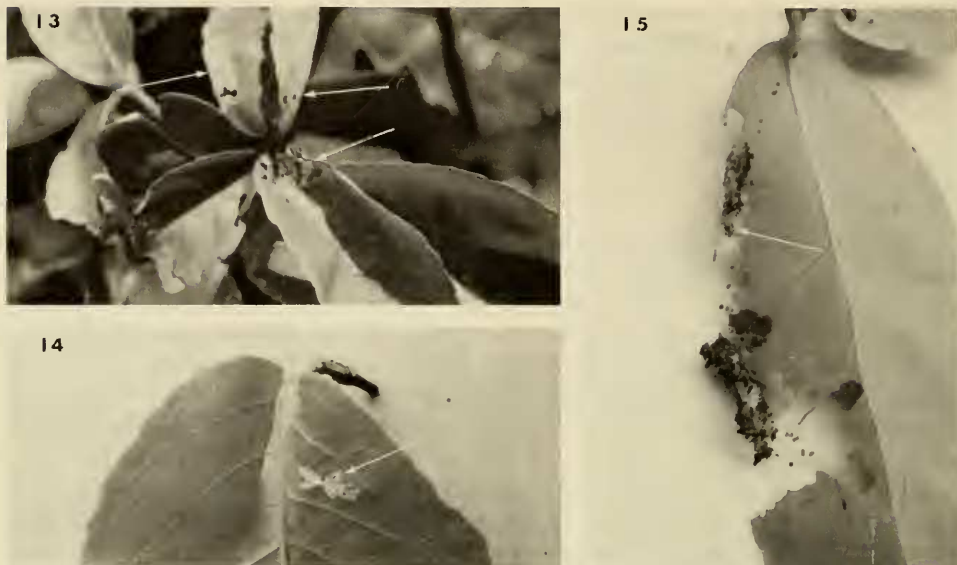
Davara caricae (Dyar)²

Ulophora caricae Dyar, 1913: 218.

Last stage larva (Figs. 2, 8, 11).—Length 12.5–15.2 mm, avg. 13.9 mm; width 1.9–2.4 mm, avg. 2.2 mm.

Color.—Head yellowish-brown with dark brown to black tonofibrillary platelets and brown to dark brown broadly distributed suffusions, including a patch associated with the ocelli (suffusions sometimes black in living larva); labrum yel-

² According to Heinrich (1956), *Davara caricae* (Dyar) is probably a junior synonym of *Davara columnella* (Zeller).



Figs. 13–15. 13, Injury (arrows) to terminal leaves of *Hippocratea volubilis* by small larvae of *Hypargyria slossonella*. 14, Feeding damage (arrow) to leaf of *H. volubilis* by early stage larva of *H. slossonella*. 15, Feeding injury, frass and silk enclosures, and larva (arrow) of *H. slossonella* (*H. volubilis* leaf).

lowish-brown; antennae light brown to brown (dark brown to black in living larva); mandibles yellowish-brown, reddish-brown distally; spinneret pale brown.

Prothoracic shield mostly yellowish-brown dorsally and mostly dark brown (black in living larva) ventrally; some dark brown (black in living larva) along dorsomesal margins and dark brown (black in living larva) platelets; pigmentation in ventral areas of shield forming anterior part of sst and est stripes.

Prespiracular plates mostly yellowish-brown with dark brown (black in living larva) platelets and other dark brown maculation.

Remainder of prothorax mostly yellowish-white (living larva whitish-yellow sometimes suffused with red); sst and est stripes dark brown to black; usually dark brown to black anteroventrally.

Meso- and metathorax and abdomen mostly yellowish-white with relatively indistinct brown md and sd stripes (sd stripe fragmented and sometimes very faint) (md stripe purplish-brown and sd stripe reddish-brown mottled with purplish-brown in living larva) and dark brown partially fused sst and est stripes (sst and est stripes dark purplish-brown in living larva) (interstitial areas and region ventral to stripes in living larva whitish-yellow, sometimes mottled with red).

Mesothoracic SD1 pinacula rings dark brown (black in living larva).

Eighth abdominal segment SD1 pinacula rings dark brown (dark brown to black in living larva).

Thoracic legs mostly brown to dark brown (sometimes black in living larva).

Anal shield brownish-yellow with darker platelets and maculation.

Pinacula brown to dark brown (sometimes black in living larva), relatively small.

Tonofibrillary platelets on remainder of body indistinct.

Head.—Width 1.05–1.22 mm, avg. 1.8 mm; surface slightly sculptured; adfrontals reach ca. $\frac{2}{3}$ distance to epicranial notch; AF2 setae usually near forking of epicranial suture; AF2 setae below an imaginary line between P1 setae; P1 setae further apart than P2 setae; labrum distinctly emarginate; mandibles simple, distal teeth distinct; mesal sensilla trichodea with 2 teeth; spinneret long, ca. $6.5\times$ as long as median breadth.

Prothorax.—Shield with distance between D1 setae less than distance between XD1 setae, on each side distance between SD1 and SD2 setae greater than distance between D1 and XD2 setae, distance between D1 and D2 greater than distance between D1 and XD1 setae, and XD2, SD1, and SD2 setae form an acute angle; prothoracic L setae nearly vertical.

Meso- and metathorax.—SD1 pinacula rings of mesothorax well developed; on each side of mesothorax and metathorax D1 and D2 pinacula fused and SD1 and SD2 pinacula fused; SD1 setae on mesothorax ca. $2\times$ as long as SD1 setae on metathorax.

Abdomen.—Anterior segments with D2 setae ca. 0.7 mm long, D1 setae ca. $0.8\times$ as long as D2 setae; distance between D1 and D2 setae on each side of segments 3–6 slightly less than distance between D1 and SD1; segments 1–7 lack pinacula rings at base of SD1 setae; postspiracular tonofibrillary platelets relatively well developed on segments 3–6; crochets in a tri- to biordinal ellipse, numbers on prolegs of segments 3, 4, 5, 6, and anal segment 50–58, 52–66, 52–60, 54–66, and 42–48, respectively; spiracles of segment 8 with vertical diam. ca. $1.7\times$ those of segment 7, with horizontal diam. ca. $1.2\times$ distance between L1 and L2 setae; SD1 pinacula rings of segment 8 relatively broad and complete; SD1 setae of segment 8 ca. $1.5\times$ as long as SD1 setae of segment 7; 2 SV setae on each side of segments 8 and 9; on each side of segment 9, D1 distinctly closer to SD1 than to D2; all pinacula separate.

Pupa (Fig. 5).—Length 7.0–8.4 mm, avg. 8.0 mm; width 2.3–2.5 mm, avg. 2.4 mm.

Color.—Yellowish-brown to pale reddish-brown; 10th abdominal segment dark reddish-brown; gibba mostly dark reddish-brown.

Head.—Slightly uneven; pilifers not separated by sclerite of labial palpi; length of maxillae 5.0–5.4 mm; avg. 5.2 mm; setae minute.

Thorax.—Prothorax wrinkled; spiracles present; mesothorax wrinkled, without punctures; metathorax slightly wrinkled with ca. 60 punctures on each side of meson extending about $\frac{4}{5}$ distance from meson to lateral margin; setae minute.

Abdomen.—Segments 1–4 with proximal $\frac{2}{3}$ densely punctate dorsally; punctures of 4 almost reaching spiracles; segments 5–7 with distinct punctures encircling proximal $\frac{1}{2}$ to $\frac{2}{3}$ of segments; spiracles elliptical, slightly raised, length ca. 0.07 mm; segment 4 with D1, SD1, and L2 setae; segments 5–7 with D1, SD1, L2, and SV2 setae; segments 8, 9, and 10 without setae; gibba $4.5\times$ as wide as median length; caudal margin of gibba with small punctures; cremastral “spines” consisting of 4 centrally located, posteriorly directed, relatively robust “spines” with strongly curled tips, and 2 outer postero-laterally directed, relatively robust, slightly hooked “spines”; outer “spines” ca. $\frac{1}{2}$ – $\frac{2}{3}$ length of inner “spines.”

Material examined.—Florida, Plantation Key, 12 larvae, *Carica papaya*, 16-V-1979, L. R. Grimes, 2 pupae reared from additional larvae, same data.

Distribution.—In the United States, *D. caricae* occurs only in southern Florida (Heinrich, 1956). The species also is common in Central and South America.

Biology.—Adults have been collected most months of the year in southern Florida and in Central and South America (Heinrich, 1956; Kimball, 1965). Eggs are usually placed on the developing fruit, or sometimes on other parts, of papaya (*Carica papaya* L.). Small larvae feed primarily on the leathery surface of the fruit, usually covering themselves with small amounts of silk and frass. Preferred sites for feeding are in crevices between fruits, between fruits and stems, and between the peduncle and stem. Frequently, several larvae feed together, and, in time, thick mats of frass collect on the fruits or other parts of the host plant, concealing the larvae (Figs. 16, 18). Late instars carve shallow chambers in the surface of the fruit (Fig. 17). Larvae apparently seldom enter the fleshy inner pulp. Pupation occurs in the soil.

Sarasota plumigerella Hulst

Sarasota plumigerella Hulst, 1900b, 222.

Last stage larva (Figs. 3, 9, 12).—Length 8.5–11.5 mm, avg. 10.2 mm; width 1.6–2.0 mm, avg. 1.8 mm.

Color.—Head yellowish-white to yellowish-brown with pale brown tonofibrillary platelets (yellowish-brown with pale brown to brown platelets and sometimes faint green undertones in living larva); labrum yellowish-brown; antennae yellowish-brown; mandibles yellowish-brown, reddish-brown distally; spinneret pale brown.

Prothoracic shield yellowish-white to yellowish-brown usually with pale brown to dark brown patch (sst and est stripe) laterally, brown to dark brown usually at base of SD setae, and sometimes brown platelets and other small amounts of brown maculation (yellowish-brown with pale brown to black maculation in living larva).

Prespiracular plates yellowish-white to yellowish-brown with brown platelets.

Remainder of prothorax mostly yellowish-white, sometimes with red mottling; sst and est stripes dark brown (pale brown to dark reddish-brown or black in living larva).

Meso- and metathorax and abdomen mostly yellowish-white, sometimes with faint to moderately distinct, usually fragmented, pale brown to brown md and sd stripes (stripes pale to dark reddish-brown in living larva) and pale brown to dark brown, strongly fused, sst and est stripes (stripes pale brown to dark reddish-brown to black in living larva) (interstitial areas and area ventral to stripes, in living larva, whitish-yellow, sometimes pink or mottled with pink).

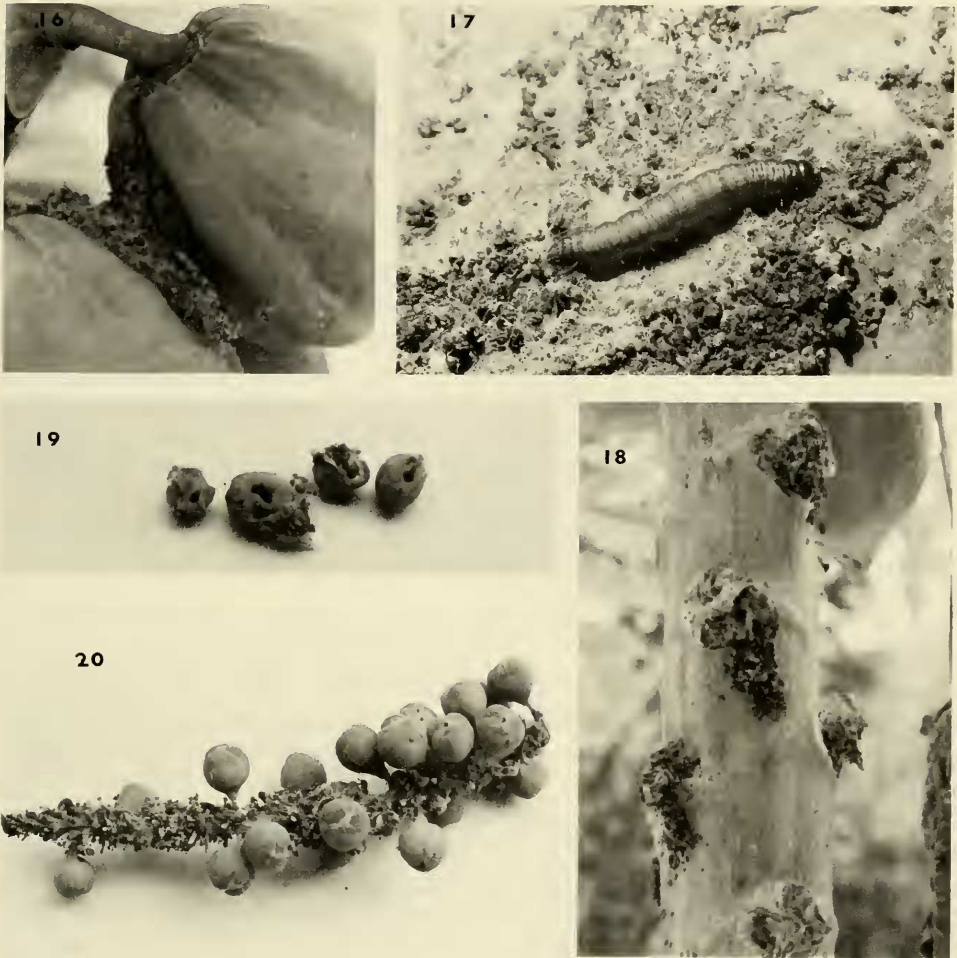
Mesothoracic SD1 pinacula rings dark brown (black in living larva).

Eighth abdominal segment SD1 pinacula rings dark brown (sometimes black in living larva).

Thoracic legs mostly pale brownish-yellow (brown and pale brown in living larva).

Anal shield brownish-yellow, sometimes heavily suffused with dark brown (suffusions sometimes black in living larva).

Pinacula pale brown to dark brown (some pinacula sometimes black in living larva).



Figs. 16–20. 16, Papaya (*Carica papaya*) fruit and accumulated frass and silk of larva of *Davara caricae*. 17, Last stage larva of *D. caricae* and characteristic shallow feeding injury on surface of fruit of papaya. 18, Accumulations of frass and silk of larva of *D. caricae* on trunk of papaya. 19, Fruit of sea grape bored into by larvae of *S. plumigerella*. 20, Cluster of fruit of sea grape (*Coccoloba uvifera*) with accumulations of frass and silk of larvae of *Sarasota plumigerella* along raceme.

Tonofibrillary platelets on remainder of body indistinct.

Head.—Width 0.99–1.19 mm, avg. 1.12 mm; surface rugulose; adfrontals reach ca. $\frac{2}{3}$ distance to epicranial notch; AF2 setae usually at level of forking of epicranial suture; AF2 setae usually on or slightly below imaginary line between P1 setae; P1 setae further apart than P2 setae; labrum shallowly emarginate; mandibles simple, distal teeth distinct; mesal sensilla trichodea, with 2 teeth; spinneret long, ca. $6.5\times$ as long as median breadth.

Prothorax.—Shield with distance between D1 setae less than distance between XD1 setae, on each side distance between SD1 and SD2 setae greater than distance between SD1 and XD2 setae, distance between D1 and D2 setae greater than

distance between D1 and XD1, and XD2, SD1, and SD2 form an acute angle; prothoracic L setae nearly vertical.

Meso- and metathorax.—SD1 pinacula rings of mesothorax well developed; on each side of mesothorax and metathorax D1 and D2 pinacula usually separate and SD1 and SD2 usually fused; SD1 setae on mesothorax ca. $2\times$ as long as SD1 setae on metathorax.

Abdomen.—Anterior segments with D2 setae ca. 0.5 mm long, D1 setae ca. $0.8\times$ as long as D2 setae; distance between D1 and D2 setae on each side of segments 3–6 greater than distance between D1 and SD1; segments 1–7 lack pinacula rings at base of SD1 setae; crochets in a triordinal ellipse, number on prolegs of segments 3, 4, 5, 6, and anal segment 64–66, 62–66, 64–66, 66–74, and 66–70, respectively; spiracles of segment 8 with vertical diam. ca. $2\times$ those of segment 7, with horizontal diam. ca. $1.1\times$ distance between L1 and L2 setae; SD1 rings of segment 8 relatively broad and complete; SD1 setae of segment 8 ca. $1.9\times$ as long as SD1 setae of segment 7; 2 SV setae on each side of segment 9; D1 usually closer to SD1 than to D2; all pinacula separate.

Pupa (Fig. 6).—Length 7.3 mm; width 2.1 mm.

Color.—Yellowish-brown to pale reddish-brown; 10th abdominal segment dark reddish-brown; gibba mostly dark brown.

Head.—Slightly wrinkled; pilifers separated by labial palpi; length of maxillae 4.4 mm; setae minute.

Thorax.—Prothorax slightly wrinkled; spiracles present; mesothorax slightly wrinkled, without punctures; metathorax slightly wrinkled with ca. 40 punctures on each side of meson, extending ca. $\frac{3}{4}$ distance from meson to lateral margin; setae minute.

Abdomen.—Segments 1–4 with proximal $\frac{1}{2}$ to $\frac{2}{3}$ densely punctate dorsally; punctures of 4 not reaching spiracles; segments 5–7 with distinct punctures encircling anterior $\frac{1}{2}$ to $\frac{2}{3}$ of segments; spiracles elliptical, slightly raised, length ca. 0.05 mm; segment 4 with D1, SD1, and L2 setae; segments 5–7 with D1, SD1, L2 and SV2 setae; segments 8, 9, and 10 without setae; gibba $4\times$ as wide as median length; caudal margin of gibba with row of small punctures; cremastral “spines” consisting of 4, centrally located, relatively long, closely associated, hooked, “spines” and 2 outer, curved, almost as long, similar “spines.”

Material examined.—Florida.—Lower Matecumbe Key, 3 larvae, *Coccoloba uvifera*, 23-V-1981, L. R. Grimes; 1 pupa reared from an additional larva, same data.

Distribution.—*S. plumigerella* apparently occurs only in southern Florida (Heinrich, 1956).

Biology.—According to Heinrich (1956) and Kimball (1965), adults of *S. plumigerella* have been collected only in March and April. Obviously, more than one generation occurs each year, however, for during the present study larvae were collected in May, and adults were reared from some of these larvae in June.

Host plants recorded for *S. plumigerella* are seagrape (*Coccoloba uvifera* (L.)) and white mangrove (*Laguncularia racemosa* Gaertner). Leaves, flowers, and fruit may be eaten. On seagrape, larvae frequently feed on the fruit, boring into and usually completely hollowing out individual berries (Fig. 19). A silk and frass covering, which conceals the larva, is laid down along the racemes and around the base of the developing achenes (Fig. 20). Pupation occurs in the soil.

ACKNOWLEDGMENTS

Host plant determinations were made by J. W. Hardin of the Botany Department, North Carolina State University (scientific names of host plants follow Long and Lakela (1971)).

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